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How to Make a 29% Increase Look Bigger: The Unit Effect in Option Comparisons

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Quantitative information can appear in different units (e.g., 7-year warranty = 84-month warranty). This article demonstrates that attribute differences appear larger on scales with a higher number of units; expressing quality information on such an expanded scale makes consumers switch to a higher-quality option. Testifying to its practical importance, expressing the energy content of snacks in kilojoules rather than kilocalories increases the choice of a healthy snack. The unit effect occurs because consumers focus on the number rather than the type of units in which information is expressed (numerosity effect). Therefore, reminding consumers of alternative units in which information can be expressed eliminates the unit effect. Finally, the unit effect moderates relative thinking: consumers are more sensitive to relative attribute differences when the attribute is expressed on expanded scales. The relation with anchoring and implications for temporal discounting and loyalty programs are discussed.

As a consumer, would your preference for a dishwasher depend on whether its warranty level is expressed in months rather than years? Would you be more likely to choose an option that indicates its superior quality in units of 1,000 rather than 10? We argue herein that you would, in both cases. That is, consumers tend to perceive the same attribute differences as larger on scales that have many units than on scales with fewer units, such that the difference between ratings of 7 and 9 on a 0–10 scale appear smaller than the difference between 700 and 900 on a 0–1,000 scale. This scale-dependent perception of attribute differences may induce increased preferences for the product with the superior score.

While previous research indicates that a change in the unit in which quantitative information is provided affects consumer preferences (Burson, Larrick, and Lynch 2009), the exact mechanism has not been demonstrated before. This article shows that the same attribute differences appear larger on scales with many units (expanded scales) than on scales with fewer units (contracted scales). In addition, this research demonstrates that this unit effect results from the fact that consumers tend to ignore the unit in which information is provided and focus on the sheer number instead. In particular, we show that reminding consumers that the same information could have been specified in an alternative unit eliminates the unit effect. We also extend prior research by demonstrating the unit effect for a consequential choice. Finally, this article integrates the unit effect with work on relative thinking (e.g., Saini and Thota 2010) as we show that a change in scale may affect the influence of relative attribute differences. This implies that relative and absolute attribute differences interact to affect consumer evaluations.

Quantitative information is common in various situations, including product features and evaluations, service satisfaction, scholastic achievements, and job applicant aptitudes. This article demonstrates that the choice of unit to describe quantitative information may have profound con-

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sequences for consumers' perceptions, preferences, and choices. The unit effect that we document is relevant for any setting in which quantitative information appears or is sought by consumers or decision makers. That is, whenever people engage in quantitative comparisons of options, the number of units used to express the difference may alter preferences and decisions.

THE UNIT EFFECT

Quantitative information can usually be specified in alternative units. A distance can be specified in miles and in kilometers. Temperature can be specified in Fahrenheit and in Celsius. Prices can be specified in different currencies. When consumers are confronted with quantitative information specified in an unfamiliar unit, they may try to translate it to a familiar unit. For instance, while in the United States, to figure out the weather forecast, European consumers try to translate temperatures specified in Fahrenheit to temperatures in the familiar Celsius scale. United States consumers engage in the opposite calculation when vacationing in Europe. This translation is carried out to be able to evaluate the numbers one is confronted with. Often this translation is rather difficult, and consumers guesstimate rather than exactly calculate the corresponding score in a familiar unit.

The inexact translation to a familiar unit may render consumers susceptible to anchoring effects. For instance, consumers often spend less in a foreign country if the value of one unit of the foreign currency is lower than the value of one unit of their own currency, compared with the opposite scenario (face-value effect; Raghubir and Srivastava 2002). When budgets and income also get transformed into the foreign currency, though, the opposite phenomenon—a reverse face-value effect—occurs (Wertenbroch, Soman, and Chattopadhyay 2007). Thus, prices seem higher in Mexico than in Great Britain (e.g., a US$20 blouse costs about Mex$247 but about £13), a face-value effect, whereas the residual budget after spending seems larger in Mexican pesos than in British pounds, a reverse face-value effect.

While consumers may spontaneously translate information specified in an unfamiliar unit to a familiar unit, in a host of circumstances consumers may not engage in any form of translation. This is particularly the case when no preferential target for translation exists. So, while the preferential target of translation exists for a foreign currency, namely, the domestic currency, for many types of attribute information, no preferential target of translation may exist. For instance, a score of 1,000 can be translated into a score on a 100-, 10-, or 50-point scale, but there is no particular reason to do so. Translating the attribute information from one unit to another unit usually does not make the attribute information (or the difference between two attribute levels) easier to evaluate. Correspondingly, consumers may not feel the need to translate the attribute information to a different unit. In fact, even though the choice of unit may be rather arbitrary, the notion that the attribute information could have been specified in an alternative unit probably does not even enter consumers' minds.

In the absence of routine translation to a different unit to evaluate the difference between two attribute levels, consumers may just focus on the number of scale units used to express a certain difference and ignore the type of unit in which quantitative information is provided (cf. numerosity heuristic; Pelham, Sumarta, and Myaskovsky 1994). When focusing on the sheer number of a difference, all quantities become dimensionless. As a result, higher numbers then represent bigger quantities. Ignoring the unit in which information is specified may lead consumers, for instance, to appreciate a 24-month warranty difference more than a 2-year warranty difference or to think that a 200-point difference on a 1,000-point scale represents a bigger difference than a 2-point difference on a 10-point scale. Clearly, when the unit in which information is provided affects perceived differences between alternative options (unit effect), this should also lead to changed preferences and choices.

Several studies are consistent with the hypothesized unit effect. For instance, shortly after the introduction of the euro, French consumers perceived the price gap between the more expensive national brands and the cheaper private labels as smaller when prices were expressed in euros versus in French francs, resulting in an increased transaction value for the national brands (Gaston-Breton 2006). Considering that the euro is a contracted price scale compared to the French franc scale (€1 = FF 6.56), this finding seems consistent with the proposed unit effect. However, it is not clear whether this so-called accordion effect exemplifies a unit effect or results from anchoring. Immediately after the change of French francs to euros, French consumers may have tried to make sense of prices in euros by translating them to French francs. As this involves a rather difficult translation, French consumers may have estimated rather than calculated the prices, and anchoring may have ensued.

More direct evidence for the unit effect was provided by Burson et al. (2009), who demonstrated that changing the scale in which attribute information is provided may indeed affect consumer preferences. For instance, in Burson et al.'s first study, participants chose between two plans that allowed them to rent a certain number of movies within a given time period; the authors found that participants preferred the cheaper plan when the number of movies available for rent appeared on a per week basis (contracted scale). However, they chose the more expensive option when the available movies were presented per year (an expanded scale). While Burson et al. do not provide a test of the underlying mechanism, they also claim that switching from a contracted scale to an expanded scale may increase perceived attribute differences and, as a result, may increase the ease with which consumers can discriminate between alternatives and the relative weight attached to the various attributes.

Our article extends this earlier work in several respects. First, it directly shows that expanded scales lead to inflated perceptions of attribute differences. Second, we provide evidence that these altered perceptions lead to changes in preferences and affect real behavior. This lends additional credence to the idea that the unit effect may be a rather general phenomenon. Third, this article contributes to our understanding of numerosity effects by delineating the unit effect from related phenomena, in particular the (reverse) face-value effect. More specifically, we propose that different processes drive these two phenomena. The (reverse) face-value effect results from difficult translations of prices and budgets, which demand that consumers estimate, rather than calculate, the domestic prices and budgets. Large denomination prices and budgets likely prompt overestimations, whereas small denominations may lead to underestimations. In contrast, the unit effect is not due to deficient translation; most people know that a 200-unit difference on a 1,000-unit scale is equivalent to a 2-unit difference on a 10-unit scale. However, consumers do not engage in any translation at all, as they fail to consider that information on a 1,000-unit scale could have been expressed on an alternative scale. It is this failure that leads to the neglect of the unit in which the information is provided. Accordingly, reminding consumers that the same information could have been specified in an alternative unit eliminates the unit effect. Fourth, while various studies indicate that consumers are sensitive to attribute ratios (e.g., Hsee et al. 2009; Kwong and Wong 2006), this article shows that this sensitivity is moderated by the number of units used to describe the attribute.

OVERVIEW OF STUDIES

In study 1, participants receive information regarding two options that differ on a single attribute. The information regarding this attribute is expressed either on a contracted scale or on an expanded scale. Study 1 demonstrates the basic unit effect: consumers perceive an objective attribute difference as bigger when the number of units expressing the difference is greater. In study 2, participants receive price and quality information for three brands, such that the lower-quality information would appear more attractive. It shows that multiplying the quality ratings by 100 reduces the attractiveness of the lower-quality option. In addition, mediation analysis indicates that this shift toward the higher-quality option is due to an increase in perceived quality differences. As studies 1 and 2 use hypothetical situations, study 3 tests whether the unit in which information is specified affects real choices as well. Participants receive energy content information in an expanded or a contracted scale and are given a choice between an apple and a Twix bar. The choice of the apple increases when the energy information is specified on an expanded scale, albeit only for participants with no prior interest in food energy information.

Study 4 focuses on the underlying cause of the observed unit effect and tests whether reminding consumers of alternative units in which information can be expressed reduces the unit effect. Participants are asked to indicate their willingness to pay (WTP) for expedited delivery for products purchased online, expressed either in days or in months. When the alternative unit (months or days) is not made salient, a higher WTP is observed when expedited delivery is specified in days rather than in months. However, reminding participants of the alternative unit eliminates this effect entirely. Finally, as several lines of research suggest that consumers often pay attention to relative differences between options, study 5 tests how a change in unit may affect this sensitivity to relative differences. It demonstrates that, consistent with the observed unit effect, relative differences gain in impact when expressed on an expanded scale.

STUDY 1: THE UNIT EFFECT

When consumers compare attribute levels, they may not be sure about how to conceive of a given attribute difference (Hsee 1996; Yeung and Soman 2005) and therefore may resort to the numerosity heuristic (Pelham et al. 1994). This heuristic emerges when consumers estimate the total quantity of a set of elements from the number of elements in that set but do not take the type of elements sufficiently into account (Pelham et al. 1994). When consumers evaluate the difference between two attribute levels, they may pay more attention to the number of units rather than the type of units. As a result, we hypothesize

> **H1:** Consumers perceive an objective attribute difference as bigger when the number of units expressing the difference is greater (unit effect).

To test hypothesis 1, participants received information about a single attribute for two options, either on a scale with few units (contracted scale) or on a scale with many units (expanded scale). Participants then indicated the size of the difference between the two options.

To test the generality of the presumed unit effect, we use three stimulus variations. First, we varied the focal attributes among probability of success of a medical treatment, television quality ratings, and dishwasher warranty levels. Second, we varied the scales that presented the attribute information, using either a 0–10 scale or a 0–1,000 scale for the probability of success of a medical treatment and television quality ratings, as well as years versus months for the dishwasher warranty levels. Third, we either left the objective difference the same for both scales (dishwasher) or made it slightly smaller in the scale that contains more units (medical treatment success, television quality).

Method

In return for partial course credit, 210 students (129 men, 81 women) from various majors at Ghent University participated in the study (mean age = 20.28 years; SD = 1.97). The participants were told that they would have to compare two television sets on the basis of an overall quality score, two surgical procedures on the basis of the probability of success, or two dishwashers on the basis of their warranty. In the latter situation, the two warranties lasted for 7 versus 9 years or 84 versus 108 months. In the other two situations, the attribute scores for the two options were 7 versus 9 (on the 10-point scale) and 704 versus 903 (on the 1,000-point scale). After viewing the two options, participants indicated how large they considered the difference to be between the two options, on a 6-point scale without a neutral option (6 = very large; 1 = very small).

Results and Discussion

We conducted separate *t*-tests for each of the three situations to determine whether the perceived differences are larger when the attribute information involves many units than when it features fewer units. In two of the three situations, we found significantly larger perceived differences when the information is expressed through many units. In the remaining situation (TV), the results were similar albeit only marginally significant. Still, the observed unit effect did not significantly differ across the three situations ($F(2, 204) = 0.61$, $p = .54$; see table 1).

The first experiment confirms hypothesis 1. For all situations, the perceived difference between two options increases as the scale presenting the information includes more units. In the medical success and television quality scenarios, the objective difference actually is smaller in the 1,000-unit condition (199/1,000) than in the 10-unit condition (2/10). In addition, in the 1,000-unit condition, the difference occurs slightly higher on the scale than in the 10-unit condition. Because of diminishing sensitivity (Kahneman and Tversky 1979), this second finding also implies that the perceived difference should be slightly smaller in the 1,000-unit condition than in the 10-unit condition if no unit effect were present. Thus, these two scenarios actually represent somewhat conservative tests of hypothesis 1, as their slightly lower effect sizes, compared with the dishwasher scenario, support.

STUDY 2: FROM UNIT EFFECT TO PREFERENCE REVERSAL

The aim of study 2 is threefold. First, we want to test whether a change in the unit in which attribute information is provided leads to changed consumer preferences. Although Burson et al. (2009) have already demonstrated that this may be the case, we aim to replicate it using a different methodology. This would testify to the robustness of such an effect. Second, and more important, we aim to investigate the process involved in the change in preferences. In particular, we want to investigate whether the effect of the number scale units on perceived attribute differences (cf. study 1) mediates the presumed effect on consumer preferences. Third, we want to examine whether the scale-dependent perception of attribute differences is due to the association of big numbers with big quantities or results from the more general process of magnitude priming (Oppenheimer, LeBoeuf, and Brewer 2008).

To achieve these aims, we draw on the attraction effect (Huber, Payne, and Puto 1982) to create a situation in which consumers find a lower-quality option attractive. That is, the participants in study 2 receive information about the price and quality of three home cinema systems. The attraction option (B) dominates a decoy option (C) because it offers the same quality but at a lower price, which also should make it more attractive than the target option (A) that offers a higher quality but at a higher price. However, when we display the quality ratings in many units, the perceived quality differences should increase, such that participants may be willing to pay more for the higher-quality option (target option). So, we propose:

> **H2:** The effect of the number of attribute units on the probability of choosing the superior option is mediated by an increased perceived quality difference.

Note that we do not investigate the effect of the number of units on the attraction effect itself. That would require conditions without the decoy option. We merely draw on the attraction effect as a tool to show that changes in the number of units in the quality ratings may lead to changes in preferences.

We divide this investigation into two parts. In study 2A, we record participants' choices, whereas in study 2B, we additionally ask participants to indicate their perceptions of quality and price differences. Including these two judgment tasks serves two functions. First, we can test whether the effect of the number of units on choice is mediated by its effect on perceived quality differences. Second, this addition enables us to consider an alternative account based on magnitude priming (Oppenheimer et al. 2008). When quality

TABLE 1

PERCEIVED DIFFERENCES AS A FUNCTION OF SCALE FOR THREE CONDITIONS: STUDY 1

Condition/scale	Attribute scores	Perceived difference	*t*	*p*	η^2
Dishwasher warranty:					
Years	7 vs. 9	3.60 (SD = 1.20)	$t(84) = 2.80$	<.01	.085
Months	84 vs. 108	4.28 (SD = 1.03)			
Television quality:					
10 unit	7 vs. 9	4.26 (SD = .82)	$t(60) = 1.77$	.08	.049
1,000 unit	704 vs. 903	4.61 (SD = .76)			
Medical success probability:					
10 unit	7 vs. 9	4.90 (SD = .98)	$t(60) = 2.09$	.04	.068
1,000 unit	704 vs. 903	5.32 (SD = .54)			

TABLE 2

PROBABILITY OF CHOOSING ATTRACTION, DECOY, AND TARGET OPTIONS AS A FUNCTION OF THE NUMBER OF SCALE UNITS: STUDY 2

	Study 2A (N = 73)				Study 2B (N = 96)			
	10 (n = 36; %)	1,000 (n = 37; %)	LR $\chi^2(1)$	p	10 (n = 50; %)	1,000 (n = 46; %)	LR $\chi^2(1)$	p
Target option	19	46	5.95	.02	14	43	10.59	.001
Decoy option	6	0	2.89	.09	4	9	.91	.34
Attraction option	75	54	3.53	.06	82	48	12.73	<.001

NOTE.—LR = likelihood ratio.

information gets expressed as many units, respondents may imagine greater quantity, which could then distort any subsequent judgment. In particular, a magnitude-priming explanation for our findings would suggest that the number of units used to express quality information should increase perceived differences for not only the quality dimension but also the price dimension. Yet, if the unit effect occurs because consumers do not routinely translate information to a different scale, then the unit effect should be restricted to the quality dimension and not occur for the price dimension. So, we expect:

H3: Changing the scale of quality ratings affects perceived quality differences but not perceived price differences.

Method

For the combined study, 169 students (70 men, 99 women) from various majors at Ghent University participated and received partial course credit (mean age = 19.53 years; SD = 1.66). Participants considered price and quality information about three fictitious home cinema systems on manipulated scales for the quality information. Half of the participants considered a score on a 1,000-point scale, whereas the other half saw expressions on a 10-point scale. The decoy option indicates identical quality as the attraction option but a higher price (quality: 7/10 or 700/1,000; price: decoy = €275, attraction = €250), and the target option is higher on both (quality: 7.5/10 or 750/1,000; price: €300). In study 2A, participants merely indicated the brand they would choose; in study 2B, they also evaluated the quality and price differences between the attraction option and the target option on a 6-point scale (1 = very large; 6 = very small). We reversed these scores before analysis.

Results

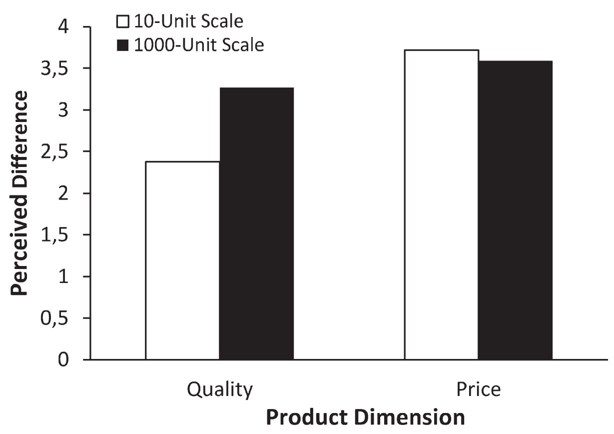
Brand Choice (*Both Studies*). The scale significantly affects the chosen brand in both study 2A (likelihood $\chi^2(2, N = 73) = 8.10$, $p = .018$) and study 2B (likelihood $\chi^2(2, N = 96) = 12.86$, $p = .002$). The probability of choosing the target option increases significantly in the 1,000-unit-scale condition, whereas the probability of choosing the attraction option decreases, although only marginally significantly in study 2A (see table 2). Although participants choose the attraction option more often than the target option in the 10-unit-scale condition, which implies an attraction effect, they do not in the 1,000-unit-scale condition.

Rating Scales (*Study 2B*). We use a 2 (number of units for quality: 10 vs. 1,000) × 2 (dimension: quality vs. price) ANOVA with repeated measures on the second factor for perceived quality and price differences. A main effect indicates that price differences ($M = 3.66$) seem greater than quality differences overall ($M = 2.80$; $F(1, 94) = 35.25$, $p < .001$). Another main effect reveals higher judgments in the 10-unit condition ($M = 3.05$) than in the 1,000-unit condition ($M = 3.42$; $F(1, 94) = 7.75$, $p < .01$). The main effects are qualified by a dimension × number of units interaction ($F(1, 94) = 13.06$, $p < .001$; see fig. 1). We find a unit effect for perceived quality difference ($M_{10} = 2.38$ vs. $M_{1,000} = 3.26$; $t(94) = 4.54$, $p < .001$), although not for perceived price difference ($M_{10} = 3.72$ vs. $M_{1,000} = 3.59$; $t(94) = .68$, NS).

Mediation Analysis (*Study 2B*). Following the procedure described by MacKinnon (2008) for testing mediation in categorical data (i.e., brand choice), we find that the observed unit effect on target option choice is fully mediated

FIGURE 1

PRICE AND QUALITY JUDGMENTS AS A FUNCTION OF THE NUMBER OF UNITS: STUDY 2



by the unit effect on perceived quality differences (Sobel test: $z = 3.048$, $p = .002$).

Discussion

Study 2 indicates that the number of attribute scale units may affect consumer preferences. That is, increasing the number of units used to provide the attribute information shifts consumers' preferences to the option that is superior on that attribute. In addition, the unit effect on consumer preferences is entirely the result of a unit effect on perceived attribute differences (hypothesis 2). Finally, in support of hypothesis 3, changing the unit in which quality was expressed affected perceived quality differences but did not alter perceived price differences. This is expected as price information was neither expanded nor contracted. This pattern of results is inconsistent with an alternative account that relies on magnitude priming (Oppenheimer et al. 2008).

STUDY 3: NUDGING HEALTHY CHOICES

The previous demonstrations of the unit effect all involve choices and decisions that entail no real consequences for the participants. Study 1 focused on perceptions; study 2 involved hypothetical choices. The aim of study 3 is to demonstrate that a change in unit may also affect real choices. In the current study, participants were offered the choice of a snack: an apple or a Twix. We provided all participants with energy content regarding the two options, either in kilocalories or in kilojoules. As 1 kilocalorie equals 4.184 kilojoules, the differences in energy content should be perceived as bigger when the energy information is expressed in terms of kilojoules than in terms of kilocalories. As a result, we hypothesize.

H4: The choice of the apple (lower energy content than Twix) should be higher in the kilojoules condition than in the kilocalories condition.

In this study, we also explore whether habitual interest in energy information moderates the unit effect. We expect the unit effect to have a larger effect on consumers who have demonstrated no prior interest in energy information. As energy information is often provided both in kilojoules and in kilocalories, consumers who typically pay attention to this information may, at least implicitly, have learned the existence of the alternative unit and thus may be less likely to neglect the unit type.

Method

In exchange for course credit, 56 undergraduates of Tilburg University participated in a 1-hour session of unrelated experiments. At the end of the session, participants had to sign up at the experimenter's desk to complete registration. As a way of thanking the students for their participation, they were offered the choice between an apple and a Twix bar, which were presented in baskets on the experimenter's desk. The baskets were provided with energy labels in kilojoules (247 for apple vs. 1,029 for Twix) or kilocalories (59 for apple vs. 246 for Twix). The experimenter (blind to the hypothesis) switched the labels in between participants as much as possible. So participants were randomly assigned to the kilojoules or the kilocalories condition according to the order in which they left their cubicle and approached the experimenter.

To justify the use of energy labels, we told participants that policy makers are raising voices to put energy counts on menus and to increase the visibility of energy labels on food products. Because of this ongoing debate, we as "consumer scientists" decided to better communicate the energy content of the products offered in the lab. After this brief introduction, the participants could make their choice. Additionally, we asked for their habitual use of energy counts: "to what extent do you usually look at the energy content of products" and "to what extent do you consider energy content when choosing food or drinks" on a 7-point rating scale anchored by "never" to "always." We aggregated these two self-report measures into an overall "prior interest in energy information" index (Cronbach's $\alpha = .78$).

Results

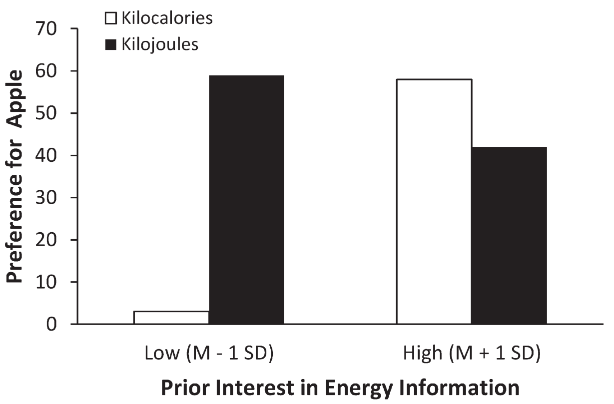
A binary logistical regression of the snack choice was conducted, with energy label (kilojoules vs. kilocalories), prior interest in energy information—treated as an interval level variable—and the interaction between energy label and prior interest in energy information as the independent variables. As hypothesized, participants were more likely to chose the apple in the kilojoules condition compared to the kilocalories condition (Wald $\chi^2(1) = 4.69$, $p = .03$). Overall, the probability of choosing the apple in the kilocalories condition was 18%, compared to 41% in the kilojoules condition. This main effect, however, was qualified by a significant interaction between energy label and prior interest in energy information (Wald $\chi^2(1) = 4.56$, $p = .033$). Figure 2 shows the estimated probabilities of choosing the apple in both scale conditions, for participants who scored 1 SD below the mean and for participants who scored 1 SD above the mean of prior interest in energy information ($M = 3.46$; $SD = 1.53$). For participants with a low prior interest in energy information, the estimated probability of choosing an apple significantly increased from about 3% to 59% (Wald $\chi^2(1) = 4.36$, $p = .037$). For participants with a high prior interest in energy information, the estimated probability of choosing an apple did not significantly change (58% vs. 42%; Wald $\chi^2(1) = 0.63$, $p = .43$).

Discussion

While the previous studies involved perceptions or hypothetical choices or both, the current study demonstrated that changes in scale can affect real choices. To the best of our knowledge, this is the first demonstration of the unit effect in real life. Specifically, the current study shows that providing food energy information in kilojoules rather than

FIGURE 2

ESTIMATED PROBABILITY OF CHOOSING AN APPLE OVER A TWIX BAR AS A FUNCTION OF ENERGY LABEL AND PRIOR INTEREST IN ENERGY INFORMATION: STUDY 3



in kilocalories makes participants more likely to choose an apple over a Twix bar.

In addition to showing the unit effect in a real choice, the current study also revealed a boundary condition. While the unit effect was observed for participants who typically do not pay attention to energy information, it was not observed for participants who typically do. Assuming that consumers who typically pay attention to energy information know of the existence of both the kilocalorie and the kilojoule specification and the relation between them, this failure to obtain a unit effect for knowledgeable participants may already suggest that the unit effect occurs only if people tend to neglect the unit in which information is provided. However, consumers who habitually pay attention to caloric information may also be more likely to have some approximate idea of the caloric content of an apple and a common candy bar. As such, their behavior may be less affected by the caloric information offered at the time of choice. Study 4 will therefore provide a more direct test that reminders of alternative units eliminate the unit effect.

STUDY 4: ELIMINATING THE UNIT EFFECT

The obtained unit effect on the perceived attribute differences seems most consistent with the idea that consumers pay attention to the numerical quantities but do not (or insufficiently) take into account the unit in which the quantitative information is offered. Consumers likely do not spontaneously translate numbers on one scale to numbers on another scale, so they may not realize that a seemingly big difference would not appear as big on an alternative scale. In fact, consumers may even fail to realize that the information could have been offered in entirely different units. Possibly, when consumers are made aware of the fact that quantities may be specified as different numbers on different scales, the unit effect can be reduced or even eliminated. So, we propose:

> **H5:** The unit effect is reduced when consumers consider that quantitative information could have been expressed in another unit.

In addition, we hope to replicate the unit effect in a situation that is radically different from the previous ones. More specifically, in study 4, participants have to decide whether they would pay more for an earlier delivery of a product they bought. The earlier delivery is specified as either 1 month or 31 days. The unit effect implies that consumers should be more likely to pay more for expedited delivery (ceteris paribus) when they can gain 31 days than when they can gain "just" 1 month. However, this effect should be eliminated if consumers are reminded of the fact that expedited delivery specified in days could have been specified in months and vice versa.

Method

One hundred and seventy-eight students (88 men, 90 women) with various majors at Ghent University participated in exchange for partial course credit (mean age = 21.26 years; SD = 0.65). The study was a 2 (temporal frame: 1 month vs. 31 days) × 2 (salience of an alternative temporal frame: not salient vs. salient) between-subjects design. All participants were confronted with 12 situations in which they had to decide whether they would like to upgrade for an expedited delivery at the cost of a higher price. The 12 situations result from a 2 (product: CD vs. cell phone) × 2 (initial delivery date: in 3 months vs. in 12 months) × 3 (price increase for expedited delivery: 5% vs. 10% vs. 15%) design, in which all variables were manipulated within participants. Expedited delivery always referred to receiving the item 1 month earlier. The use of 12 situations helps to assess the robustness of the hypothesized effects.

To manipulate the temporal frame, for half of the participants, the temporal information was specified in months (i.e., initial delivery in 3/12 months and decided whether to pay more for earlier delivery by 1 month) or in days (i.e., initial delivery in 91/365 days and decided whether to pay more for earlier delivery by 31 days). To manipulate the salience of an alternative temporal frame, before the delivery choice task, all participants engaged in a subjective time estimation task. Using a slider, they indicated for 12 time periods whether it involved a very short period or a very long period. For half of the participants, all time periods referred to the unit they would be exposed to later (i.e., either all in months or all in days). For the other half, six of the time periods referred to days, while six others referred to months. In the time estimation task as well as in the choice task, the order of the items was randomized and different for each participant.

Results

As each participant made 12 binary choices, a multilevel logistic regression model was estimated. We estimated several models that all included product (CD vs. cell phone; dummy variable), initial delivery date (in 3 vs. in 12 months; dummy variable), price increase for expedited delivery (5% vs. 10% vs. 15%; two dummy variables), and experimental condition (three dummy variables). We tested various models; the best model—both empirically and theoretically—included all the predictors specified above.

We first discuss the parameter estimates that are of little theoretical importance but which show that our respondents were affected by the relevant information for each situation: the respondents were more likely to opt for the earlier, more expensive delivery, as earlier delivery became less expensive ($\chi^2(2) = 60.60$, $p < .001$), when the original delivery date was 3 rather than 12 months from now ($\chi^2(1) = 21.85$, $p < .001$), and for the CD than for the cell phone ($\chi^2(1) = 26.09$, $p < .001$).

We now turn to the most relevant factor, the experimental condition. The results indicate that the preference for earlier delivery varied across the four experimental conditions ($\chi^2(3) = 8.56$, $p = .036$). When the subjective time estimation task did not render an alternative temporal frame salient, the unit effect was obtained: a higher preference for earlier delivery when this meant obtaining the product 31 days earlier compared to obtaining it 1 month earlier ($\chi^2(1) = 4.54$, $p = .033$). In contrast, when the subjective time estimation task made an alternative temporal frame salient, the unit effect was eliminated ($\chi^2(1) = 0.01$, $p = .99$).

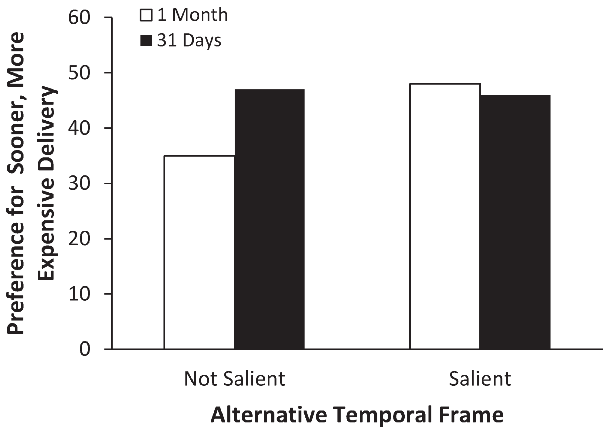
To grasp this pattern more easily, figure 3 shows the observed choice probability averaged across the 12 different situations for each condition. It shows that the probability of opting for earlier delivery is lowest (35%) when the information was specified in months and participants are not made aware that this could have been specified in days. When the information was specified in days and participants are not made aware that this could have been specified in months, the probability of opting for earlier delivery was much higher (47%). When the alternative time scale was made salient in the subjective estimation task, the probability of opting for earlier delivery did not depend on whether the time information was specified in months (48%) or days (47%). The three latter probabilities did not differ significantly (all $p > .75$), but they all differed from the former one (all $p < .04$).

Discussion

The results corroborate our reasoning that consumers do not routinely think of the alternative scales on which the same quantitative information could be provided. As a result, changing the unit in which information is offered affects perceived attribute differences and thus leads to different preferences and choices. When people have to decide on paying more for expedited delivery, they are more likely to do so when the product is delivered 31 days earlier than when it is delivered 1 month earlier, despite the equivalence of these two time periods. This replicates the unit effect observed in the previous studies. However, when the possible translation of one temporal frame to another is first made salient, the unit effect is eliminated (hypothesis 5).

FIGURE 3

PREFERENCE FOR EARLIER DELIVERY AS A FUNCTION OF THE TEMPORAL FRAME AND SALIENCE OF THE ALTERNATIVE TEMPORAL FRAME: STUDY 4



The fact that the probability of opting for earlier but more expensive delivery is lower when consumers can gain 1 month rather than 31 days reflects the fact that 31 days is seen as a bigger gain than 1 month is. What is somewhat intriguing, though, is that in the two conditions in which participants are made aware of alternative time frames, a higher preference for the expedited delivery is observed when compared to the original 1-month condition. Moreover, the preference in those two conditions is identical to the preference in the original 31-days condition. At first sight, one may expect the probabilities in the two conditions in which the alternative temporal frames are made salient to lie in between the other two conditions. However, as these participants now start paying attention to the time unit, their perception of the time gain may no longer differ between "1 month" and "31 days." As it happens, the time gain they associate with earlier delivery appears to be similar in the two conditions in which the alternative temporal frames are made salient and in the original 31-days condition. This suggests that the time gain is particularly underestimated when consumers are told that they could gain 1 month but do not realize that this is equivalent to 31 days.

STUDY 5: THE UNIT EFFECT AND RELATIVE THINKING

Studies 1–4 indicate that the scale used for attribute information may affect consumer evaluations and decisions. However, in those studies the changes in units in which the information was expressed did not change the ratios or proportional differences. Still, studies of number representation in both animals and humans reveal that the mental magnitude associated with a given number is a logarithmic function of the objective number (Dehaene 1997, 2003; Dehaene, Dehaene-Lambertz, and Cohen 1998; Nieder and Miller 2003). Therefore, the same objective difference becomes subjectively smaller when it refers to higher numbers, so the difference between 100 and 101 seems smaller than the difference between 1 and 2. As a result, consumers seem particularly sensitive to proportional attribute differences and attribute ratios (e.g., Hsee et al. 2009; Kwong and Wong 2006). To reconcile the observed unit effect with consumers' sensitivity to ratios or proportional differences, we consider whether the scale that expresses an attribute may increase or decrease the impact of such ratios and proportional differences. In particular, we test the following hypothesis:

H6: Consumers are more sensitive to attribute ratios and proportional differences when the attribute is expressed in many units.

In study 5, we ask participants to compare a set of home cinema systems with varying quality levels to a system with perfect quality and then indicate how much more they would be willing to pay for the perfect system than for each other system in the set. We again manipulate the scale used to provide the quality information (10 vs. 1,000 units). We also propose the following relation between WTP and the quality of the systems:

$$\mathrm{WTP} = \alpha\left(\frac{Q_p - Q_c}{Q_p}\right),$$

where Q_p refers to the perfect quality level, and Q_c is to the quality level of the current system. The equation above thus describes a linear relationship between WTP and the proportional difference between the qualities of the systems. The slope α should relate positively to the number of units used to provide quality information: that is, willingness to pay extra for the perfect system should increase more steeply when the quality information appears on the 1,000-unit scale than when it is expressed on the 10-unit scale.

Method

Seventy-one students (28 men, 43 women) with various majors at Ghent University participated for partial course credit (mean age = 22.34 years; SD = 4.12). Participants received quality information about 12 focal home cinema systems, although half considered this information on a 1,000-point scale, and the other half saw a score on a 10-point scale. Participants imagined winning one of the systems but also could upgrade to a perfect system in exchange for money. Each participant therefore indicated, for the 12 systems, how much more they would be willing to pay (in euros) for the perfect home cinema system. The quality of the 12 systems ranged from 4 (400) to 9.5 (950), in steps of 0.5 (50).

Results

To test for outliers, we first regressed each participant's WTP estimates on the quality of the focal system. For two participants, the slope was more than 3 SD above the mean slope; for one participant, the intercept was more than 3 SD above the mean intercept. We discarded data from these three participants.

We next regressed WTP (in euros) on the number of units (10 vs. 1,000) and the quality of the focal system for the remaining participants. To test whether the slope differs across unit conditions, we include the interaction between the number of units and focal quality. A multilevel linear regression model accounts for the repeated-measures nature of the data. The analysis reveals a main effect of focal quality ($F(1, 66) = 102.66$, $p < .001$), which is qualified by a significant interaction with the number of units ($F(1, 66) = 15.06$, $p < .001$). Therefore, the slope is higher in the 1,000-unit condition ($\alpha = 343.42$) than in the 10-unit condition ($\alpha = 153.22$).

The regression model depends on the assumption of linearity, so we undertake an alternative analysis in which we subject the WTP data to a 2 (number of units: 10 vs. 1,000) × 12 (proportional difference: 5%–60%) ANOVA with repeated measures on the second factor. This ANOVA yields significant main effects of both proportional difference ($F(11, 66) = 11.83$, $p < .001$) and number of units ($F(1, 66) = 6.56$, $p = .013$). As we hypothesized, we also find a significant interaction between proportional difference and number of units ($F(11, 66) = 11.83$, $p < .001$). When the focal quality is very good (9.5/10 or 950/1,000) and the proportional difference is 5%, no significant difference in WTP appears between the two scale conditions ($M_{10} = 19.61$ vs. $M_{1,000} = 27.29$; $t(66) = 1.06$, $p = .29$). When the focal quality is rather bad, though (4/10 or 400/1,000), with a proportional difference of 60%, the WTP for the perfect system increases significantly in the 1,000-unit condition compared with the 10-unit condition ($M_{10} = 155.00$ vs. $M_{1,000} = 281.71$; $t(66) = 2.96$, $p < .01$).

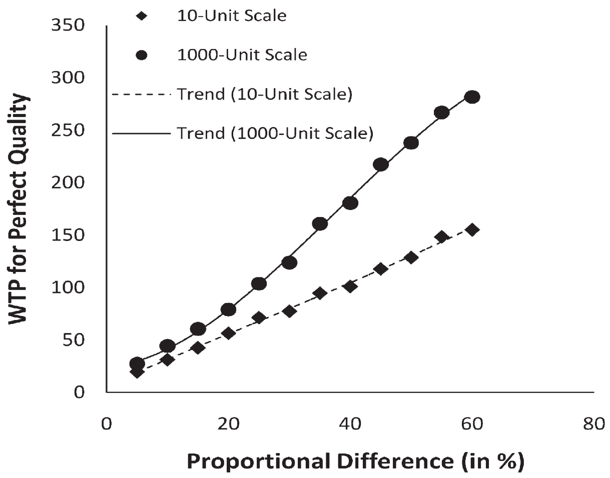
Finally, follow-up interaction trend tests confirm that the linear relationship differs in the 1,000-unit compared with the 10-unit condition ($F(1, 66) = 9.72$, $p < .001$). Of the interaction trend tests, only the cubic test is also significant ($F(1, 66) = 5.48$, $p = .02$). We display, in figure 4, the mean WTP for each proportional difference, along with a fitted polynomial. In the 10-unit condition, the data can be described adequately by a linear function, whereas in the 1,000-unit condition, the relation between proportional difference and WTP slightly departs from linearity at both ends of the displayed curve. The resulting sigmoid curve requires both a linear and a cubic trend to describe it.

Discussion

To reconcile our results with consumers' sensitivity to proportional differences, we posit that the influence of proportional differences depends on the number of units used to express an attribute, such that the proportional difference

FIGURE 4

MEAN WILLINGNESS TO PAY (WTP) FOR PERFECT QUALITY AS A FUNCTION OF CURRENT QUALITY AND SCALE: STUDY 5



sensitivity may increase with the number of scale units (hypothesis 6). Study 5 supports this line of reasoning. The slope that relates the proportional quality difference to WTP becomes steeper when the quality appears in terms of 1,000 units than when it is expressed in terms of 10 units. Therefore, the difference in WTP between the 10- and 1,000-unit conditions should be more pronounced for greater objective quality differences than for smaller objective quality differences. Participants indicate they would pay significantly more in the 1,000-unit condition than in the 10-unit condition for a perfect system when the focal system offers poor quality, although not when the focal system is nearly perfect.

GENERAL DISCUSSION

When consumers receive quantitative information, they are sometimes unfamiliar with the unit in which it is expressed. For instance, consumers may receive price and budget information in a foreign currency or temperature and distance information in a metric system they are not accustomed to. In such circumstances, they probably try to make sense of the given information by estimating or calculating the corresponding value in a familiar unit. In other cases, however, the unit may seem much more arbitrary, and consumers may readily accept the unit in which quantitative information is expressed rather than try to translate it to another unit. However, quantitative information can often be expressed in different units. Changes in the unit in which information is specified may lead to preference reversals (Burson et al. 2009).

This article extends prior research on the unit effect in several respects. First, we document that the process underlying preference reversals is due to changes in the unit of quantitative information: when the same attribute difference appears in the form of more units, consumers perceive it as larger (study 1 and 2). Such changes in perceptions lead to an increased preference for the option that is superior on the focal attribute (study 2). Second, to the best of our knowledge, this article is the first to show a unit effect in real consumer choices (study 3). Third, we show that the unit effect occurs because consumers fail to take into account that the same information could have been specified in an alternative unit—reminding them of this fact eliminates the unit effect (study 4). Fourth, we show that the unit in which attribute information is provided affects consumers' sensitivity to proportional differences and ratios of attribute levels (study 5).

One may wonder to what extent the unit effect may be simply due to the logarithmic relation between numbers and their mental representation. However, while this relation implies that the same unit difference appears smaller when the numbers involved are higher (i.e., the 2-unit difference between 109 and 107 appears smaller than the 2-unit difference between 9 and 7), it does not imply that a certain difference also appears smaller when it is expressed on an expanded scale. In fact, a logarithmic mental number account would make the opposite prediction. While the objective proportional difference between a 7-year warranty and a 9-year warranty is the same as that between an 84-month warranty and a 108-month warranty: $(9 - 7)/9 = (108 - 84)/108 = .22$, the subjective proportional difference is bigger in the former situation: $(\log(9) - \log(7))/\log(9) = .11 > (\log(108) - \log(84))/\log(108) = .05$. This indicates that the observed unit effect cannot simply be reduced to the logarithmic relation between numbers and their mental representation.

We believe that the unit effect occurs when consumers fail to take into account the unit in which quantitative information is expressed. As a result, they treat the numbers they receive as dimensionless quantities. In this situation, bigger numbers represent larger quantities than smaller numbers. Correspondingly, when attribute differences are expressed as many units, they are thought to be larger than when they are expressed as fewer units. In a sense, the unit effect occurs because people focus on the number of units rather than the type of units.

Several other phenomena result from a similar failure to adequately account for the type of unit involved. For instance, people incorrectly believe cancer is riskier when statistics report that it affects 1,286 of every 10,000 persons than when they report that it causes the death of 24.14 per 100 persons (Yamagishi 1997; see also Raghubir 2008). People also prefer to draw from an urn with 10 winning and 90 nonwinning possibilities than from one with 1 winning and 9 nonwinning possibilities (Kirkpatrick and Epstein 1992; see also Denes-Raj and Epstein 1994). Such a ratio bias appears to relate to experiential processing, in that people can simulate drawing a winning possibility (or contracting a disease) more easily when the number of possibilities increases. However, because in our studies the numbers refer to things other than probabilities, differences in ease of simulation cannot explain the unit effect. In addition, the ratio bias appears to emerge for small probabilities only (Denes-Raj and Epstein 1994), but the unit effect is stronger when the objective difference is high (study 5).

Previous studies have also demonstrated several currency numerosity effects: the value of foreign prices and budgets is overestimated when the foreign denomination is larger than the domestic one and underestimated when lower. This (reverse) face-value effect seems to be driven by anchoring: people's estimated quantities, prices, or budgets gravitate toward a number (the anchor) that became accessible immediately before the judgment (Blankenship et al. 2008; Tversky and Kahneman 1974). One may wonder to what extent the documented unit effect similarly results from anchoring.

Anchoring occurs when people's numeric judgments (e.g., estimate how long the Mississippi is) are affected by a number or magnitude that is activated before they render their judgment. The literature on anchoring distinguishes between two mechanisms (Blankenship et al. 2008; Wegener et al. 2010). A first mechanism involves thoughtful, elaborative processing. This mechanism operates when people are first asked to consider a certain number as an estimate —the anchor—and, subsequently, to give their own estimate. People's own estimates are affected by the anchor because it increases the accessibility of information consistent with the anchor (Strack and Mussweiler 1997). We did not ask our participants to contemplate any number as a potential response, so the unit effect cannot be explained by high-elaboration anchoring.

A second mechanism involves nonthoughtful processes. This mechanism operates when people are asked to write down an arbitrary number (Ariely, Loewenstein, and Prelec 2003) or to draw long versus short lines (Oppenheimer et al. 2008). Although the anchor itself is not considered a viable response, it may indirectly affect numeric responses through number or magnitude priming (Critcher and Gilovich 2008; Wilson et al. 1996; Wong and Kwong 2000). Several aspects of our findings are also not congenial to an interpretation in terms of low-elaboration anchoring. First, we observe the unit effect also when participants did not give numerical responses but simply made choices (study 2A, 3, and 4). Second, it is unclear how anchoring would explain that the unit effect is eliminated when participants are reminded of the existence of an alternative unit, considering that the information they received was not changed (study 4). Finally, in study 2B, no unit effect occurs for judgments of price differences. Because basic anchoring does not require relevance (Critcher and Gilovich 2008; Wong and Kwong 2000), the failure to obtain a unit effect on dimensions that relate empirically to the focal dimension also strongly argues against an interpretation based on anchoring effects.

Although we argue that neither high-elaboration nor low-elaboration anchoring may explain the unit effect, one might conceptualize the unit effect as a different form of anchoring. First, even when consumers are not asked how big the difference is between two attribute levels, to make any choice, they need to evaluate the difference. As such, they generate an internal magnitude appraisal. Second, one could view the numeric difference as an anchor that affects the internal magnitude appraisal: differences on expanded scales lead to higher internal magnitude appraisals than differences on contracted scales. Third, while high- and low-elaboration anchoring involve insufficient adjustment from an anchor, the unit effect occurs because consumers do not adjust at all, as they do not realize that the information could have been specified in an alternative unit. Still, this view of anchoring implies that any situation in which people need to make a decision based on numeric information specified in an arbitrary unit gives rise to anchoring. So, while it is conceptually possible to extend anchoring to include the unit effect, in our view, this renders the concept of anchoring overly broad, as it implies that numerical processing would typically entail anchoring.

In our studies, we manipulated the number of scale units in which quantitative information was expressed. On expanded scales, the difference between two options consists of more units, which results in inflated perceptions of attribute differences. In some situations, however, one could expand the scale but at the same time keep the number of intervening steps constant. For example, Bagchi and Li (2011) investigated how the number of points needed for a reward in a loyalty program (e.g., 1,000 vs. 100) and the number of points acquired by a standard transaction (e.g., 10 per dollar vs. 1 per dollar) affect store loyalty and perceived progress toward the reward. In their studies, they jointly manipulated the points needed and the points acquired by a transaction (i.e., both were multiplied by a factor of 10). As such, they did not manipulate the number of steps that separate different outcomes but rather the size of the steps involved.

Bagchi and Li found that store loyalty was more affected by the number of points already acquired when 1,000 points were needed than when 100 points were needed. However, this result was only obtained when the step size was ambiguous. While the step size is ambiguous when the number of points for a similar transaction may vary (e.g., the points acquired through buying $10 of groceries depends on the specific groceries involved), it is not ambiguous when the number of points is identical for similar transactions (e.g., the points acquired is a linear function of money spent). In our studies, each scale point could be viewed as a step, and there is no ambiguity involved in the step size. We nevertheless consistently found evidence for the proposed unit effect. It seems, then, that step-size ambiguity may only moderate the effect of the number of scale points in situations in which the steps appear bigger rather than more numerous.

Further Research and Implications

Numerosity effects result from an inability to properly evaluate a given situation. For instance, slicing up a pizza into several pieces affects the estimated food quantity when the pieces are removed from the plate and displayed horizontally but not when they are left on the plate so that they still form the pizza (Pelham et al., study 1). Similarly, the (reverse) face-value effect seems limited to situations in which consumers are unfamiliar with the unit of measure (Jonas et al. 2002; Raghubir and Srivastava 2002). To the extent that a consumer becomes familiar with a foreign currency, this difference disappears (Marques and Dehaene 2004). For example, shortly after the introduction of the euro, consumers' price perceptions exhibited a face-value effect, but it dissipated rather rapidly (Mussweiler and Englich 2003; Wakker, Köbberling, and Schwieren 2007). One may wonder to what extent familiarity may also eliminate the unit effect.

Familiarity with an attribute may entail learning the distribution of the attribute levels. Such knowledge may affect the perception of differences between attribute levels (cf. range frequency effect; Parducci 1965) more than the number of scale units that the differences consist of. Still, the knowledge of the distribution of attribute levels is very specific. Hence, even though knowledge about the distribution of quality ratings on a 100-point scale for one product may eliminate the unit effect for that product category, a unit effect may still be obtained for 100-point quality ratings for a different category. In addition, familiarity may also increase the likelihood that consumers are aware of an alternative unit in which the information can be specified. This seems sufficient to eliminate the unit effect. It is, however, not entirely clear why this happens. Two mechanisms are viable. Awareness of the existence of an alternative unit may prompt consumers to translate the information of one unit into another. An alternative is that reminders of an alternative unit make consumers more likely to try to eliminate the unit altogether. More specifically, it may prompt them to engage in relative thinking and ignore the absolute differences. Of course, more research is needed to test these speculations.

While consumers may differ in how familiar they are with certain attribute information, they also may differ in their ability to process quantitative information. In particular, some consumers appear to be more "numerate" than others. Some studies indicate that numerate people are less likely to exhibit framing effects (Peters et al. 2006). Framing effects occur when people react differently to objectively the same information, simply because it is described differently. Considering that the unit effect could be regarded a framing effect, future research may investigate whether numerate consumers are less likely to exhibit a unit effect than their less numerate counterparts. This may be the case if numerate consumers are more likely to be aware of alternative units or more readily focus on relative differences than absolute differences when comparing attribute levels. If so, differences in numeracy may underlie the interaction between energy label and prior interest in energy information that we obtained in study 3.

While we found evidence that an attribute difference is considered bigger when it is expressed as many units, several findings suggest that fewer units sometimes may evoke a greater value. For instance, people appear to value a certain amount of money more when it is specified as a small number of large bills rather than as a large number of small bills (i.e., denomination effect; Raghubir and Srivastava 2009). Furthermore, people tend to defect in a prisoner's dilemma game when they can gain US$2 rather than the equivalent amount of US¢200 (Furlong and Opfer 2009). In both cases, however, the units involved differ in associated meaning. Large bills appear to be more strongly associated to financial restraint than smaller ones (Raghubir and Srivastava 2009). In a similar vein, dollars are more potent money primes than cents (Vohs, Mead, and Goode 2006). In our situations, the unit in which the attributes were specified probably did not differ in evoked meaning: a 1,000-point scale is not intrinsically more valuable than a 10-point scale, nor does a year connote a more positive meaning than a month. Possibly, the occurrence of a unit effect may be limited to situations in which the different types of units do not entail differences in associated meaning.

Changing the unit in which information is expressed may not only affect perceptions of the attribute differences but also lead to various other consequences. For instance, when consumers are confronted with attribute information that is expressed on an expanded scale, not only may their perceptions of differences be inflated, but they may also think that more options exist with intermediate attribute values. Further, consumers may give more weight to attributes expressed on expanded scales (for a similar speculation, see Burson et al. 2009). In fact, two mechanisms may contribute to an increased weight. First, expanding the scale increases the number of levels and may also increase the perceived range of variation; both factors increase the weight attached to the attribute (Verlegh, Schifferstein, and Wittink 2002). Second, in any information exchange people rely on the Gricean maxims to make sense of the given information (Schwarz 1994). In particular, when confronted with a scale containing many units, consumers may infer that the attribute involved must be very important. This conversational logic also implies that expanded scales could be viewed as very precise, and, consequently, consumers may consider the information as more objective and accurate than they would if it had been specified on contracted scales; detailed information may, therefore, also engender more trust. More research is needed to fully understand how expanded versus contracted scales affect consumer decisions.

People's focus on the number of units, not the type, may be a general tendency that affects sensitivity to certain information. Study 4 already demonstrated that changing the unit in which a time window is expressed may affect how long it appears and, hence, how valuable the time period is. Correspondingly, in time-discounting studies, participants could grow less impatient if the wait time appears in weeks rather than days, which in turn could minimize the discounting rate. Time also seems to pass more quickly on a clock that displays tenths of seconds than one that updates only every minute (see also Read et al. 2005). Finally, the rate at which sensitivity to losses and gains diminishes (cf. prospect theory; Kahneman and Tversky 1979) may depend on the scale for expressing the attribute. That is, people may be more sensitive to both losses and gains when they appear on a scale that consists of many units. Further research should investigate this speculation.

The studies in this article were always comparative as we focused on attribute differences. However, in some situations, comparing the attribute score for one option to that of one or more other options may not be possible. Additional research may investigate whether a unit effect may be observed in those circumstances. Such research may benefit from distinguishing between open and closed scales. Closed scales provide definite endpoints, whereas open scales do not. In both cases, bigger may seem better, but people's appreciation for a particular level may differ according to the state of the scale. For example, a 108-month warranty sounds better than an 84-month warranty, but it also may be appealing on its own. In contrast, although the quality difference between 700 and 800 on a 1,000-unit scale appears rather big, 800 still might not represent a particularly good score. In fact, the appreciation of a particular score may depend on the end point with which it is compared. If consumers compare 800 to the low end of the scale (0), it seems far better than if they compare it against the high end of the scale (1,000). More research is needed to assess whether the unit of information affects consumer decisions and whether this is moderated by type of scale (open vs. closed).

We also suggest several managerial implications based on the unit effect. Brands could increase perceptions of their superiority by expressing their scores on a superior attribute in the form of many units (see also Burson et al. 2009), which may be particularly effective in comparative advertising. Loyalty programs that offer points based on the amount consumers spend also should reflect our findings. The difference between rewards A and B may seem greater if consumers must accumulate 500 points for A and 700 points for B, rather than 5 and 7 points. Thus, compared with the alarm clock for 500 points, an MP3 player for 700 points likely will seem more valuable. Consumers can become very focused on their loyalty points (cf. medium maximization; Hsee et al. 2003), and a scale with more units could stimulate them to spend more than would a reward system with fewer points. Also, when consumers have the choice between a hedonic and a functional reward, greater perceived effort makes them lean toward the hedonic reward (Kivetz and Simonson 2003). As the number of points associated with the reward increases—when there are more units—consumers may perceive their effort as greater, which could drive them toward more hedonic rewards.

Conclusion

Various studies have demonstrated phenomena that are perceived as numerosity effects. It appears that, to qualify as a numerosity effect, a given phenomenon should be consistent with the general idea that consumers associate bigger numbers with bigger quantities. However, the processes involved differ across specific phenomena. For instance, ease of simulation is involved in the ratio-bias phenomenon, and anchoring underlies the (reverse) face-value effect. In our view, there is a marked difference between basic numerosity effects, which solely are driven by the neglect of the specific unit in which quantitative information is expressed, and numerosity effects that involve other processes. In the latter phenomena, the neglect of the type of unit is more apparent than real. In currency numerosity phenomena, consumers are definitely aware of alternative currencies. In ratio-bias studies, many participants are aware of the units involved but act against rational judgment because it feels better to do so (Denes-Raj and Epstein 1994). Different types of numerosity effects may not only involve different mechanisms but, accordingly, entail different moderators as well.

This article demonstrates a unit effect: the number of units in which an attribute difference is expressed affects consumers' perceptions. In particular, differences become more pronounced on scales with many units. So, although a 9-year warranty is 29% longer than a 7-year warranty, just like a 108-month warranty is compared with an 84-month warranty, the latter 29% difference appears longer. This change in perception may lead to altered preferences but is eliminated when the alternative units in which attribute information could have been specified are made salient. Correspondingly, we consider the unit effect a basic numerosity effect. As such, we believe that it is relevant for any setting that contains quantitative information specified on a scale that consumers and decision makers consider arbitrary. In those situations, they simply fail to consider that alternative specifications may exist, and the unit effect ensues. The demonstration of unit effects in various different situations involving distinctly different attributes (see also Bagchi and Li 2011; Burson et al. 2009) testifies to this presumed generality. Although the unit effect may be obtained in a host of situations, we also pointed out some potential boundary conditions; these provide an avenue for future research.

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